

IN THE CLAIMS:

The following is a complete listing of the claims in this application, reflects all changes currently being made to the claims, and replaces all earlier versions and all earlier listings of the claims.

1. (Previously presented) A diffractive optical element made of at least two materials of different dispersions, and including at least two diffraction gratings accumulated one upon another, wherein:
- each diffraction grating is formed on a curved surface of a substrate; and
- a diffraction grating, from among said at least two diffraction gratings, in which a curvature radius of the curved surface and a curvature radius of a grating surface in a portion where a grating pitch is largest, have different signs, is one of said at least two diffraction gratings which has a smallest grating thickness.
2. (Previously presented) A diffractive optical element according to Claim 1, wherein said diffraction grating having a smallest grating thickness is structured so that an angle which is defined between the grating surface and a grating edge of that diffraction grating is obtuse and is greater than an angle which is defined between the grating surface and a normal to the surface at a position where a plane connecting grating free ends of the smallest-thickness diffraction grating and the grating surface intersect with each other.
3. (Previously presented) A diffractive optical element according to Claim 1 or 2, wherein the grating edge of the diffraction grating is made parallel to an optical axis.
4. (Previously presented) A diffractive optical element according to Claim 1 or

2, wherein the curvature of the plane connecting the grating free ends is approximately even, in each diffraction grating of said at least two accumulated diffraction gratings.

5. (Previously presented) A diffractive optical element according to Claim 1 or 2, wherein at least one of said at least two diffraction gratings is formed at an interface of two different materials having different dispersions.

6. (Previously presented) A diffractive optical element according to Claim 1 or 2, wherein said at least two accumulated diffraction gratings are bonded with each other in a non-grating region.

7. (Previously presented) A diffractive optical element according to Claim 1 or 2, wherein said at least two diffraction gratings include at least one grating of a shape in which a direction of the grating thickness is different.

8. (Previously presented) A diffractive optical element according to Claim 1 or 2, wherein said diffractive optical element is effective to improve a diffraction efficiency of a predetermined order, over a whole visible light region of a used wavelength.

9. (Previously presented) A diffractive optical element according to Claim 1 or 2, wherein there is a wavelength included in the used wavelength range which wavelength satisfies the following relation: $\pm (n01-1) d1 \pm (n03-1) d2 \pm (n02-1) d2 = m\lambda0$

where $n01$ is a refractive index of the material of a first diffraction grating with respect to a wavelength $\lambda0$, $n02$ is a refractive index of the material of a second diffraction grating with respect to the wavelength $\lambda0$, $n03$ is a refractive index of the material of a third diffraction

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grating with respect to the wavelength λ_0 , d_1 and d_2 are thicknesses of the first and second diffraction gratings, and m is a diffraction order.

10. (Previously Presented) A diffractive optical element according to Claim 1 or 2, wherein the substrate has a lens function.

11. (Previously Presented) A diffraction optical system including a diffractive optical element as recited in Claim 1 or 2.

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12. (Original) A diffraction optical system according to claim 11, wherein said optical system is an imaging optical system.

13. (Original) A diffraction optical system according to Claim 12, wherein said diffractive optical element is provided at one of a lens cemented surface and a lens surface, or inside a lens.

14. (Original) A diffraction optical system according to Claim 11, wherein said optical system is an observation optical system.

15. (Original) A diffraction optical system according to Claim 14, wherein said diffractive optical element is provided at a side of a lens, constituting the observation optical system, which faces an objective lens side thereof.

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16. (New) A diffractive optical element including a plurality of laminated diffraction gratings and at least two materials having different dispersions, said element comprising:

a first diffraction grating and a second diffraction grating provided on two curved surfaces,

wherein, in said first diffraction grating, an optical power attributable to diffraction and an optical power attributable to refraction provided at the curved surfaces have mutually different signs,

wherein, in said second diffraction grating, an optical power attributable to refraction at the curved surfaces have the same sign, and

wherein said first diffraction grating has a grating thickness larger than said second diffraction grating.

17. (New) The diffractive optical element according to Claim 16, wherein optical powers of the two curved surfaces attributable to refraction have mutually different signs.

18. (New) The diffractive optical element according to Claim 16, wherein said first diffraction grating is a diffraction grating formed on a concave surface and has a positive optical power, and

wherein said second diffraction grating is a diffracting grating formed on a convex surface and has a positive optical power.

19. (New) The diffractive optical element according to Claim 16, further comprising a third diffraction grating in close contact with said second diffraction grating and being made of a material different in dispersion from said second diffraction grating.

20. (New) A diffractive optical element having a plurality of laminated diffraction gratings, and including at least two materials having different dispersions, said element

comprising:

a first diffraction grating provided on a first curved surface, wherein an optical power of said first diffraction grating is different from an optical power due to refraction of the first curved surface; and

a second diffraction grating provided on a second curved surface, wherein an optical power of the second diffraction grating is the same as an optical power due to refraction of the second curved surface,

wherein said first diffraction grating has a grating thickness greater than the second diffraction grating.

21. (New) The diffractive optical element according to Claim 20, wherein the optical powers of the first and second curved surfaces attributable to refraction have mutually different signs.

22. (New) The diffractive optical element according to Claim 20, further comprising a third diffraction grating in close contact with said second diffraction grating and being made of a material different in dispersion from said second diffraction grating.

23. (New) A diffractive optical element having a plurality of laminated diffraction gratings laminated, and including at least two materials having different dispersions, said element comprising:

a first diffraction grating provided on a curved surface having a concave shape and a positive optical power; and

a second diffraction grating provided on a curved surface having a convex shape and a positive optical power,

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wherein said first diffraction grating has a grating thickness greater than said second diffraction grating.

24. (New) The diffractive optical element according to Claim 23, further comprising a third diffraction grating in close contact with said second diffraction grating and having a negative optical power, said third diffraction grating being made of a material different in dispersion from said second diffraction grating.
